

DEFENSE INFORMATION SYSTEMS AGENCY  
CENTER FOR COMPUTER SYSTEMS ENGINEERING  
5600 Columbia Pike  
Falls Church, VA 22041-2717

April 1996

MEMORANDUM FOR: PROGRAM MANAGERS AND DEVELOPERS

SUBJECT: Implementing DoD Standard Data Elements

I am pleased to provide our Data Element Standardization Primer that describes how to implement standard data elements for DoD software and computer systems. This primer details the processes and procedures associated with implementing, reusing, and gaining approval for DoD Standard Data Elements. DoD has approved 11,070 data standards; the primer contains information to provide you access to this tremendous resource. I encourage you to use it as a guide to assist your development efforts.

The primer will assist program managers and developers meet the needs of Warfighting customers and their support activities by providing essential information concerning DoD Standard Data Elements and the Data Administration Program. Implementation of DoD Standard Data Elements will enhance Warfighter mission performance and system interoperability. To enable the developer and manager to deliver that performance, we have designed clear and concise data element standardization procedures. Data element standardization is an important aspect of interoperable systems. It provides the coordinated means to describe and exchange information, improve communications, and eliminate redundant data across the battlefield and functional areas. The primer also identifies automated tools and assistance available to support the inclusion of data standardization within DoD-wide system development.

You are a critical component of the data standardization initiative. Your use, submission, and registration of standard data elements will ensure the continued success of the program and of our support to the Warfighter. If you have comments or questions concerning the use of standard data elements or this primer, contact me or Ms. Becky Harris, at the Defense Information Systems Agency (DISA) Center for Computer Systems Engineering (CFCSE). At the end of this primer you will find information on points of contact, Web-sites, and references that will assist you in this joint venture of data element standardization.

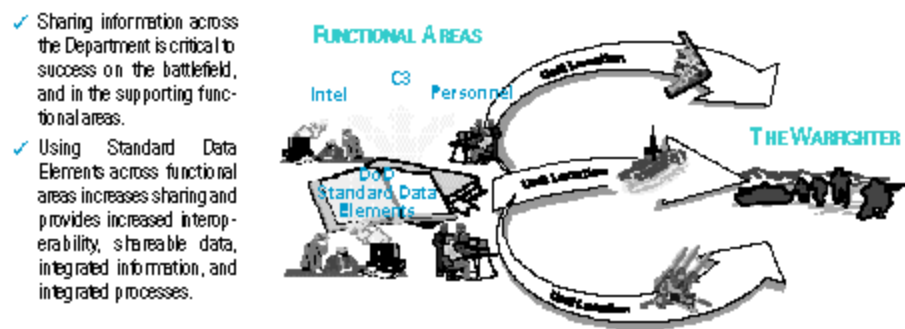
DIANN L. MCCOY  
DoD Data Administrator

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## INTRODUCTION

Sophisticated technology and systems provide today's Warfighter with enhanced capabilities designed to perform assigned peacetime and wartime missions. Many, if not all of these systems, rely on software and computer systems to provide and enhance superior performance. Interoperability between systems, including weapon, command and control, combat support, messaging, and automated information systems, can increase the performance and effectiveness of the Warfighter and supporting systems. Data element standardization provides interoperability. For example, as shown in Figure 1, combatants in a joint task force share standardized location and other information to support the overall mission. Sharing of critical location data, made possible through data standardization, enables synchronization of forces. This example shows that interoperability is a key component of readiness and combat effectiveness. We see that data elements define information across a variety of DoD systems supporting readiness. Standard data elements therefore have become as fundamental to readiness as standard ammunition or fuel.

**FIGURE No. 1**  
**INTEROPERABILITY AND STANDARD DATA ELEMENTS**



Lack of interoperability is one of the most critical problems facing the Warfighter. DoD must standardize its data elements in order to solve interoperability problems. Implementing standard data elements across functional areas minimizes the requirement for data translation software and devices and reduces the potential for breakdowns in information transfer.

For the development community, data element standardization reduces the cost, complexity, and overall level of resources expended on the development of software and computer system data components. Standard data elements are available for reuse, reducing the need to develop data models and elements, decreasing development cost. Standard data elements are available for use across functional areas, thus subjecting elements to increased review, reducing cost and complexity, and improving overall data element quality. Finally, standard data elements assist system administrators in mapping migration system data elements to DoD standard data elements, thereby accelerating required data conversion and modernization efforts.

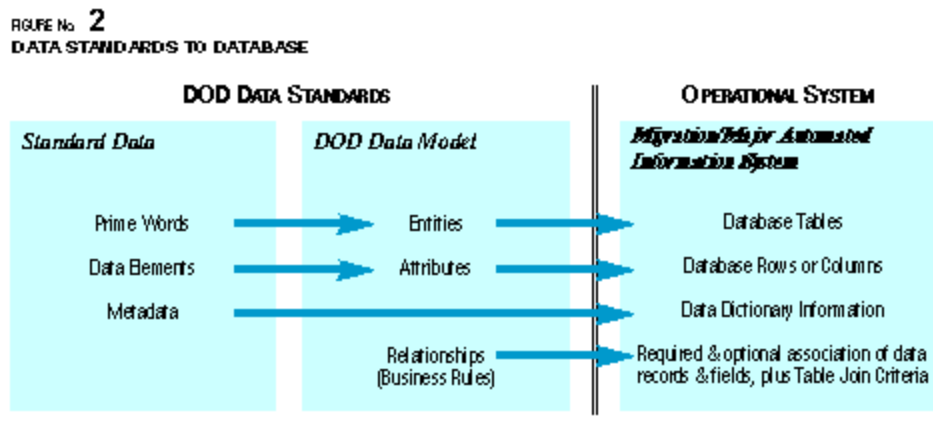
## Our Goal

This primer provides direction on how to incorporate data element standardization procedures into the software development process. Software development processes control the software and computer systems development environment for automated solutions for the Warfighter. Such automated solutions are supported by a common architecture, the Defense Information Infrastructure (DII). Integral to this architecture is the ability to share data enhanced by the use of standard data elements. Therefore, it is important to use software processes to implement standard data elements.

As a DoD software developer, you understand the importance of the software development process and the inherent need to address data requirements within the process. Today, software managers and developers must be aware of and include data, database, and database management development strategies as part of their development activities in order to ensure successful implementation of the required software or computer system application. Horizontal integration and operational requirements demand that interoperability with other systems be attained. To assist in attaining such interoperability, DoD provides developers with a DoD Data Administration program that includes Data Element Standardization procedures. This primer describes the Data Element Standardization procedures within the context of the software development process and will assist you with implementation and understanding the importance of these procedures to your development effort.

Implementation of the processes and procedures described in this primer will result in development one of the fundamental outputs of data development activities, databases.

Figure 2 shows the relationship between standard data elements, the DoD data model (DDM), and the output of data development activities, including database tables, database rows and tables, data dictionary information, and the associations between data records and fields. This relationship between the product of the data developer and the components of the DoD Standard Data Elements emphasizes the importance of data standardization and modeling in support of the development of operational systems.



## ***Data Element Standardization***

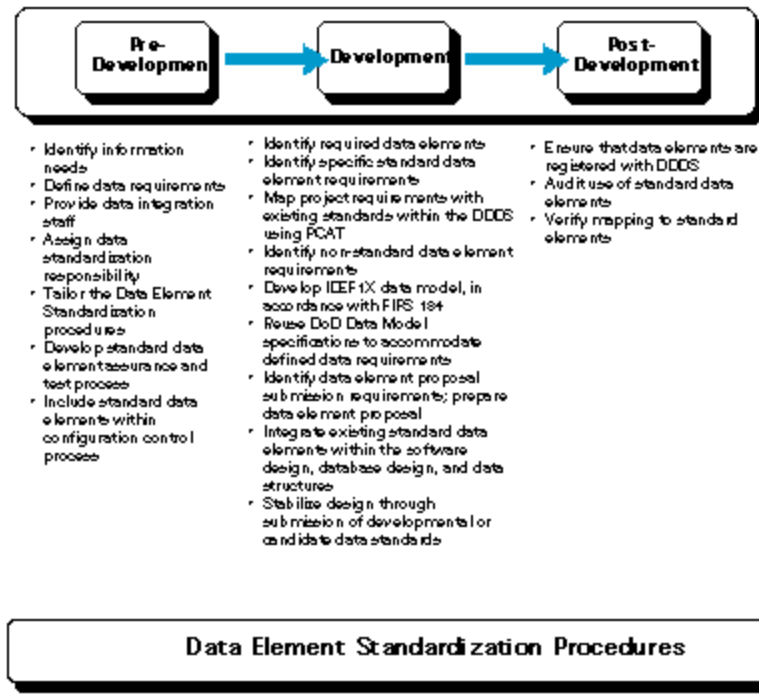
DoD 8320.1-M defines Data Element Standardization as the procedures associated with documenting, reviewing, and approving unique names, definitions, characteristics, and representations of data elements according to established procedures and conventions. This definition identifies essential components of the data environment that, when standardized, will provide the Warfighter with increased interoperability and cross-functionality across the continuum of the strategic, operational, and tactical battlespace.

## **THE SOFTWARE DEVELOPMENT PROCESS**

The software development process transforms user needs into software products through pre-development, development, and post-development phases that include activities such as planning, development, testing, and production. When used with a software development process, data element standardization procedures ensure that data are developed and standardized with the essential common information components that will allow cross-functionality and interoperability across a wide range of user applications in a complex information technology environment.

Data Element Standardization procedures support several software development strategies, including incremental and evolutionary models. Although there is a recommended point in the life cycle for each data standardization procedure activity, data standardization can be initiated and conducted throughout the life cycle of a system. For example, the same procedures used to identify and implement standard data elements for projects entering the development phase are used for projects performing re-engineering or migration development. Finally, the size of the development effort in terms of lines of code or function points is immaterial, thereby making the data element procedures an asset to all development activities. Figure 3 shows the major phases for a software development process. Each phase identifies the major data-related activities. The DoD Data Administration program, through data tools and procedures, assists the developer in each phase.

FIGURE No. 3  
SOFTWARE  
DEVELOPMENT  
PROCESS



### *Pre-Development*

**Needs Analysis:** The following Data Element Standardization issues should be addressed within the needs analysis activity:

- Identify information needs, perform business case analysis, and analyze domain constraints
- Define data requirements

**Project Planning:** Program managers and developers should address the following issues regarding data standardization:

- Integrate use of data standards in software development plan
- Provide staff knowledgeable in the development and implementation of data, database, and database administration requirements
- Assign responsibility to implement standard data elements
- Adapt the Data Element Standardization procedures and tailor them to your development effort
- Include standard data element assurance and test processes as part of up-front planning
- Include standard data elements in the development of configuration control processes

### *Development*

**Systems Requirements Analysis:** As system requirements are defined, the developer begins to identify potential domains for data standardization.

- Take specific note of interoperability and cross-functional requirements; plan for reuse of standard data elements
- Identify required data elements
- Research and identify project-specific standard data element requirements
- Map your project's data element requirements with existing standard data elements available within the Defense Data Dictionary System (DDDS) using the Personnel Computer Access Tool (PCAT)

**Software Requirements Analysis:**

- Identify non-standard data element requirements and develop data element information
- Reuse DOD Data Model (DDM) specifications to accommodate defined data requirements
- Develop DDM IDEF1X data model extension, in accordance with FIPS 184
- Identify data element proposal submission requirements, and prepare the data element proposal

**Software Design:**

- Integrate and use identified standard data elements within the software design, database design, and data structures
- Stabilize design through submission of developmental or candidate data standards

**Code and Test:**

- Obtain and use standard data elements
- Manage data standard configuration and compliance with DDDS

**Function and System Test:**

- Test and demonstrate interoperability and cross-functionality

***Post-Development***

**Product Assurance and Maintenance:**

- Ensure that data elements are registered with DDDS
- Audit use of standard data elements
- Verify mapping to standard elements

The application of data-focused activities is prevalent throughout the life cycle of a project.

Before discussing the specific procedures for data element standardization, the tools that enable standardization are discussed.

## DATA ELEMENT STANDARDIZATION TOOLS

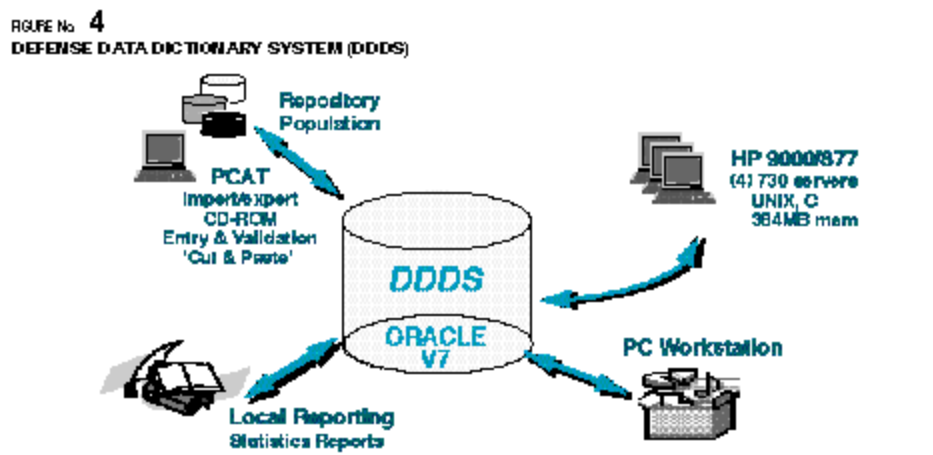
DoD is developing a DoD-wide Defense Data Repository Suite (DDRS) that will provide a wide array of data services for managers and developers. Currently available services and tools include access to the DDM, DDDS, and PCAT.

The DoD DDM is a DoD-wide data model that supports the implementation of standard data elements. The DDM defines overall information requirements and business rules that support the Warfighter and depicts the logical relationship between DoD data standards. Developers should use DDM as a basis for structuring and defining their information requirements and to ensure reuse of standard data elements within their projects.

Accessing the DDM requires the use of automated support tools. DISA provides DoD developers with two tools, DDDS and PCAT, to assist in accessing the DDM, and in using, creating, and modifying standard data elements.

### *Defense Data Dictionary System (DDDS)*

The DDDS, maintained by DISA, is the primary tool supporting DoD Data Administration. DDDS is a repository that houses, and enables centralized management of, the DDM and related information. DDDS contains all DoD standardized data elements and provides automated support for developing and managing standard data in accordance with DoD Directive 8320.1. In Figure 4, the major components of the DDDS are shown.



DDDS provides developers with access to approved standard elements and worldwide on-line query and reporting capability. DDDS also collects and stores standard data

elements and attributes. It allows users to participate in the review and approval of data standards by functionals, identify DoD organizations and processes using standard elements, and track the status of data elements through the standardization process. DDDS also allows users to access metadata (data about data), including name, definition, data steward, field length, data type, and allowable domain values that are used by software developers in DoD application development.

### ***Personal Computer Access Tool (PCAT)***

DISA developed the PCAT to provide DDDS users with a user-friendly method to access DDDS and to allow users to participate in augmenting the more than 11,070 DoD data standards available. The relationship between DDDS and PCAT is also shown in Figure 4.

PCAT contains a snapshot of the DDDS that is updated periodically. The current PCAT release is on a CD-ROM that includes:

- All current DDDS standard data elements
- All non-standard migration system data elements
- The ability to perform frequent data updates with faster import and export capabilities
- The DDM and an ERWin Model Viewer

PCAT is a multifaceted application that supports the requirements of data analysts and administrators. It combines robust search and review capabilities with comprehensive documentation and analysis tools. PCAT gives users the ability to:

- Locate existing standards quickly and easily
- Identify unsupported data requirements and create a new data element(s) to meet your requirement
- Document the partial or complete redundancy between existing data elements and data models
- Manage the transition of legacy and migration data to standard data models and standard data elements by documenting the semantic and syntactic overlaps between data
- Conduct list-based searches where you can define criteria such as the source dictionary and data type
- Conduct keyword-based searches applied to the lists to narrow the scope of a search
- Use customized filters containing conditions for metadata, and allowing you to narrow the scope of a search by looking for certain data standard characteristics
- Create associations to document overlaps and redundancy in data definitions
- Identify naming conventions to assist in name formulation for data standards
- Access a thesaurus to relate standard vocabulary to commonly used synonyms
- Preview reports on screen and print or send the report to a file

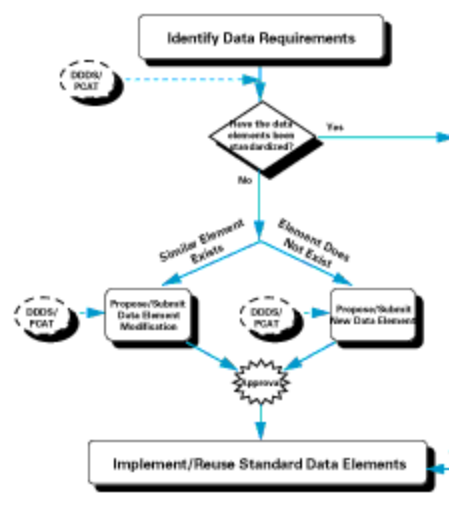


- Perform side-by-side comparisons of multiple data standards while displaying metadata

## DATA ELEMENT STANDARDIZATION PROCEDURES

The DoD has established the Data Element Standardization procedures as a component of the DoD Data Administration Program. These procedures are fully detailed in DoD Directive 8320.1-M-1. Figure 5 depicts when to use primary Data Element Standardization procedures, described in more detail later in this section.

FIGURE No. 5  
IMPLEMENTING STANDARD DATA ELEMENTS

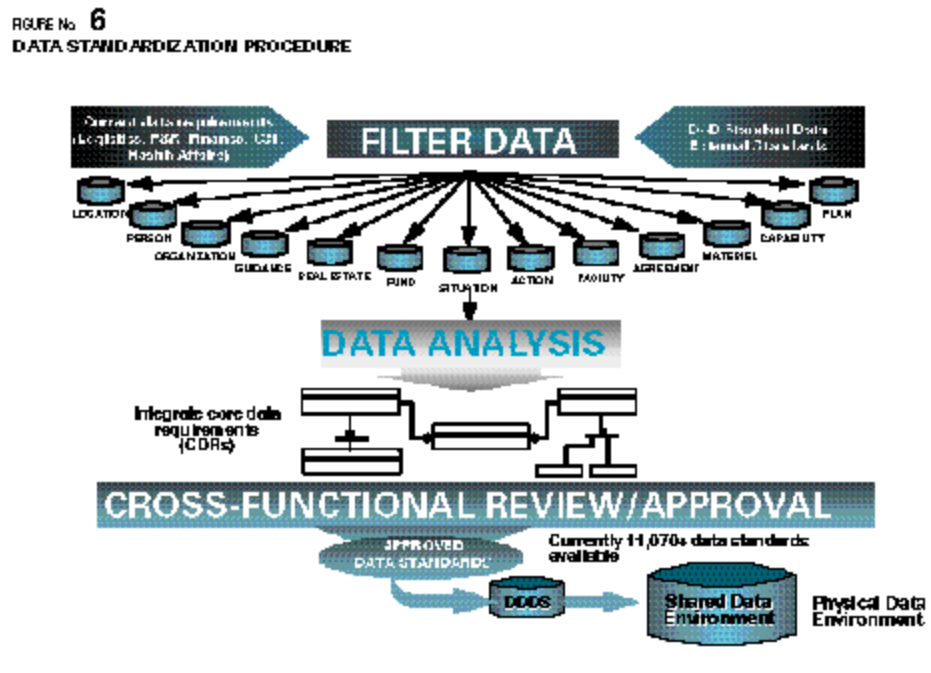


The phases of standard data elements associated with the Data Element Standardization procedures are:

- **Developmental** - Elements that have been created but may not yet be fully specified, appropriate for use, nor released by the originator for standardization review.
- **Candidate** - Elements that have been submitted by a Functional Data Administrator (FDAd) or Component Data Administrator (CDAd) for formal review.
- **Approved** - Elements that have been coordinated through the standardization process and have been deemed DoD standard data elements.
- **Disapproved** - Elements that have been coordinated through the standardization process and whose use has been disapproved.
- **Modified** - Elements that were previously approved and are currently being considered for change. These elements go through the same formal review as Candidate data elements.
- **Archived** - Elements that were formally approved but are no longer needed to support the information needs of DoD.

These phases provide structure to the activities required for implementation and integration of standard data elements within software design.

Figure 6 depicts the process flow associated with implementing standard data elements during a development effort.



This Data Element Standardization procedures model provides a framework for the integration of standard data elements within the software development process environment. The model identifies major activities within the phases, including filtering data, analyzing data, obtaining cross-functional review and approval, and submitting a new element or modification proposal to the DDDS.

### ***Data Filtering***

Data filtering is the process of identifying and refining required data elements for a development effort. Data element requirements form the basis for selection from available standards, the modification of existing standards, and the creation of new standards.

By accessing the DDDS using PCAT, you can research, analyze, and develop your data requirements on-line. Listed below are several primary data components that you will need to develop and define when constructing data objects.

- **Prime Word** - A word included in the name of a data entity, which represents the logical data grouping in the logical data model to which it belongs. (Examples - LOCATION, PERSON)
- **Generic Element** - Part of a data element that establishes the structure and limits the allowable set of values of a data element. (Examples - IDENTIFIER, CODE, NAME)
- **Data Element** - A named identifier of each of the entities and their attributes that are represented in a database. (Examples - LOCATION IDENTIFIER, LOCATION CATEGORY CODE, LOCATION NAME)

## ***Data Analysis***

An important step in developing standard data elements is to determine an element's status. For example, given your functional and system requirements, does an element with the same or similar characteristics as your element exist within the DDDS? If a "match" does exist, you can save time, effort, and money by simply adopting the standard element. If the match has to be modified in order to accommodate your requirements, you can submit proposed element changes on-line through the DDDS.

### ***What if a Data Element Has Not Been Standardized?***

If you find that your development effort requires a data element that does not exist in the DDDS, the Data Element Standardization procedures allow you to create, submit, and achieve candidacy and approval of a new data element. The ability to create and standardize data requirements that are not in the DDDS ensures that your unique and evolving development needs are met. Standardizing new data requirements also facilitates data sharing and interoperability by allowing other DoD communities to share your unique data elements.

Prior to the development of a new data element, you should review data elements that have been developed by other federal government and DoD components that have not been submitted to the DDDS. The best place to search for these data elements would be functional areas that perform functions similar to those of your organization. For example, if the Defense Finance and Accounting Service (DFAS) needs to identify financial data that are not in the DDDS, DFAS could query the Corps of Engineers Financial Management System (CEFMS) functional proponent. If you discover that the required element has been previously standardized by another organization, you may use this information within your submission to DDDS.

## ***Domain Analysis***

In addition to naming and defining your data element, you must determine the set of permissible data values, both generic and specific, from which actual values are taken for the data element. This process is known as domain analysis.

### ***Integration of Elements within the DoD DDM***

Once you have named, defined, and established a domain for your data element, you

must integrate the element within the DDM. The DDM provides a logical view of the Department's business and system data requirements in contrast to the physically stored data. Integrating the data element with a data model ensures that the data element has an identified use relative to the data entities and business rules in the model. Moreover, the DDM enables potential users to evaluate the data element for applicability to specific business and system requirements. Your data element is now referred to as "developmental".

### ***Data Element Review***

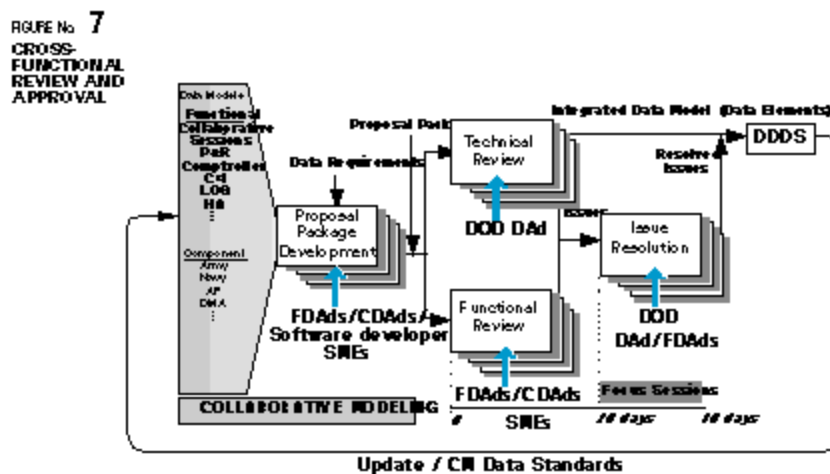
DISA provides review of data elements in a streamlined manner. Once a data element enters candidate status, the review process is designed to take only 30 days from submission to notification of approval or disapproval.

### ***Packaging Your Data Element***

Once you have completed data analysis, including incorporating the data element within a data model, you must prepare a data element proposal package and submit the proposal to the approving community. Once you have submitted a proposal for a new element or an element modification, the element under consideration becomes a "candidate" when it is staffed for cross-functional review.

### ***Standard Data Element Review***

The CDAd and FDAd have the responsibility to review candidate standard data elements. During the review, the element is assessed for functional and technical compliance. The review consists of a detailed technical evaluation performed by the DoD Data Administrator (DAd), and a detailed functional evaluation performed by a designated FDAd or data steward. A data element is either approved or disapproved based on the overall results of the review. Figure 7 shows the cross-functional review process.



## ***Approval/Disapproval***

The FDAd will formally approve or disapprove the data element as a standard. Once a new element has been approved, the standardization status of the element is set to approved within the DDDS, thereby making the element available for reuse by other DoD users and developers.

Disapproved data element proposals are returned for action and/or final resolution. Proposals may be rejected because of incomplete information, or because the proposal contains information that conflicts with existing standards. In these instances, the process gives you an opportunity to modify and resubmit your rejected proposal.

## ***Standard Data Element Modification***

For modifications, a new version of the standard data element is created. The new version will go through the candidate phase and either be approved or disapproved. If the modification (new version of element) is approved, the previous (old version) data element will be archived in the DDDS.

Developers may submit proposals to modify existing standard data elements. The submission of a modification proposal causes a previously standardized data element to revert to the stage of being considered a candidate element. The element will remain in the candidate phase until it is reviewed and approved or disapproved. If the modification is approved, the element is input into DDDS as a standard.

## ***Archive***

Standard data elements are archived after they are no longer required to support the information needs of DoD. For instance, if you submit and receive approval for a modification to a standard data element, the "old" version will be archived upon approval of your modification.

# **THE DoD DATA ADMINISTRATION PROGRAM**

The management and implementation of Data Administration within DoD is directed by DoD Directive 8320.1. This directive, and supporting procedures and manuals (DoD 8320.1-M, DoD 8320.1-M-1, DoD 8320.1-M-x) apply to all initiatives to develop, modernize, or migrate information systems, whether automated or non-automated within DoD.

## ***DoD Data Administrator***

The DoD DAd is responsible for program administration, technical infrastructure, and the operational services required to plan and implement data standards across DoD. The DISA Deputy Commander for the CFCSE is the DoD DAd. Integrating the Data

Administration role within DISA/CFCSE provides a centrally managed program that assists program managers and developers with data standardization and the inclusion of data standardization within the engineering development of future, re-engineered, and migrated computer and software systems. The DoD DAd is responsible for executing policy and procedures, and making DoD Data Standards available to the DoD systems development community.

### ***Functional Data Administrators***

The FADs are designated by an Office of the Secretary of Defense Primary Staff Assistant. The FAD is the data steward for a particular functional area and is responsible for defining data requirements for that specific functional area. DoD 8320.1-M provides detail concerning roles and responsibilities of the FAD.

### ***Component Data Administrators***

The CDAs represent their respective service or component in all matters of data administration. Specifically, CDAs review and approve planning, programming, and budget requirements within the component. Additionally, the CDA is responsible for program administration, implementation, technical infrastructure, and adherence to policy. DoD 8320.1-M provides detail concerning roles and responsibilities of the CDA.

## **DATA ELEMENT STANDARDIZATION DEFINITIONS**

**Core Data Requirement:** Core data are the most frequently exchanged data from process to process. This type of data requirement represents data required for two or more functional areas.

**Data:** The representation of facts, concepts, or instructions in a formalized manner suitable for processing. **Data Administration:** The function of the organization that oversees the management of data.

**Database:** A collection of interrelated data. **Data Dictionary:** A specialized type of database containing metadata that are managed by a dictionary system.

**Data Element:** A named identifier of each of the entities and their attributes that are represented in a database.

**Data Element Standardization:** The process of documenting, reviewing, and approving unique names, definitions, and representations of data elements according to established procedures and conventions.

**Data Model:** The user's logical view of data. Defines entities and data elements and entity interrelationships. **Data Requirements:** A specification of data needed to support a business function.

**Data Steward:** The person or group that manages the development, approval, creation, and use of data within a specified functional area.

**Data Structure:** The logical relationships that exist among units of data and the descriptive features defined for those relationships and data units.

**Defense Data Dictionary System (DDDS):** The DDDS provides developers with approved standard data elements. It physically exists on a minicomputer at the Pentagon.

**Defense Data Repository Suite (DDRS):** An integrated collection of DoD Data Administration and Data Sharing tools and repositories. Currently populated with DDDS and PCAT. This new definition of the DDRS encompasses greater capability than the former Defense Data Repository System.

**Defense Data Repository System (DDRS):** A repository for DoD generic elements, standard data elements, and prime word names. See DDDS.

**DOD Data Model (DDM):** Available within the DDDS, the DDM is a corporate-wide data model that provides standard meaning and use of specific data elements to developers.

**Domain:** The set of permissible data values from which actual values are taken.

**Functional Area:** A functional area encompasses the scope of a set of related functions and data for which OSD Principal Staff Assistant has DoD-wide responsibility, authority, and accountability.

**Information Model:** A high-level abstract representation of real-world processes, products, and interfaces.

**Metadata:** Information describing characteristics of data.

**Modeling:** Application of a standard, rigorous, structured methodology to create and validate a logical representation of a system, entity, or process. Modeling assists in the development of standard data elements by providing high-level definition.

**Non-Standard Data Element:** A data element that exists in a system or application that does not conform to the conventions, procedures, or guidelines established by the organization.

**Personal Computer Access Tool (PCAT):** PCAT is a tool developed to provide easy user access to the DDDS. It also provides the means to analyze, create, and propose DoD Data Standards.

**Process Model:** A representation of one or more activities that define an application.

**Shared Data Environment (SHADE):** (Formerly Common Data Environment, CoDE)  
The shared data environment is a strategy that identifies how to share data resources at the application level. It brings together the disciplines of data administration and database administration to identify data requirements and implement database design in a manner that promotes interoperability.

**Standard Data Element:** A data element that has been approved formally in accordance with the organization's Data Element Standardization procedures. Alternatively, standard data elements are data that have been coordinated through the standardization process and approved for use in information systems.